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FOREST INSECT INVESTIGATIONS

ACCOMPLISHMENTS ON THE BURNEY-McCLOUD INSECT CONTROL PROJECT - DURING 1945

by

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ABSTRACT

On December 8, 1944, the Berkeley Forest Insect Laboratory made recommendations for an insect control program in the Burney-McCloud area for the purpose of reducing insect-caused losses from Ips and western pine beetle, Dendroctonus brevicomis, in epidemic proportions in parts of this area.

This control job was carried out on a cooperative basis of federal, State and private participation, starting about February 15 and terminating April 15, 1945. As a result of this work the following was accomplished:

Timbered acres treated	26,760 acres
Total volume treated by direct and salvage control	4,647,300 bd. ft.
Total number trees and poles treated	14,376
Volume of timber salvaged	3,512,600 bd. ft.
Value of timber salvaged at $5.50 per M	$19,320
Estimated reduction in loss or timber saved by control on treated areas	4,500,000 bd. ft.
Value of timber saved by control at $5.50 per M	$24,750
Total volume of timber salvaged or saved	8,012,600 bd. ft.
Total stumpage value saved or salvaged	$44,070
Total cost of project - all agencies	$37,800

As a result of the control work, the large concentrations of Ips have been effectively broken up in the treated areas and the Ips infestations are now conspicuous only in a few localities outside the areas treated. It is estimated that on the treated area losses, primarily from Ips, were reduced from about 196 board feet per acre in 1944, prior to control, to about 35 board feet per acre in 1945 following control; or an average reduction of 82 percent. In contrast, losses, mostly from western pine beetle, increased on the untreated areas from about 73 board feet per acre in 1944 to about 104 board feet per acre in 1945, or an increase of about 42 percent.

Although the overall results achieved in the Burney-McCloud job have been very satisfactory, the bug problem is by no means permanently solved and further follow-up work is recommended, particularly protection through sanitation-salvage logging or maintenance control to protect the investment made and to maintain the ground gained through the initial control operations.

INTRODUCTION

Late in the winter of 1943, groups of dying ponderosa pine, poles and trees began appearing in parts of the Burney-McCloud area in northern California. This killing increased during 1944 and involved not only reproduction and poles, but larger trees of merchantable size. For the most part heavy losses were in and adjacent to areas where recent scattered ("shot-gun") logging had been carried on. The infestation was characterized by the formation of large groups of poles on cutover areas and large groups of merchantable as well as unmerchantable trees in nearby virgin areas.

Indications were that engraver beetles, Ips confusus and I. oregoni, had bred up in the logging slash from these "shot-gun" cuttings and then when no further new slash was provided, emerging beetles had attacked and killed green poles and trees in the vicinity. The usual case was for beetles emerging from slash to concentrate their attacks in the vicinity of the cutting area while beetles from subsequent generations usually migrated some distance before attacking groups of poles and larger trees. The western pine beetle, Dendroctonus brevicomis, was involved to some extent in that the basal green portion of a great many of the Ips topkilled trees were later filled in by this species, but in general practically all of the large group killing was directly traceable to initial attacks by Ips.

This loss of timber became so alarming during 1944 that steps to control and salvage the loss were called for. A meeting held on November 20, 1944, at Hat Creek, attended by local ranchers, timber owners and operators, State and federal foresters, laid plans for getting State and federal financial aid in controlling this outbreak.

On December 8, 1944, recommendations were made by the writer (1) that bark beetle control be initiated in the Burney-McCloud area to check the current serious loss of timber. It was recommended that first priority be given to controlling the concentrated Ips infestations on cutover lands and second priority to controlling western pine beetle infestations developing in virgin areas. It was estimated that $39,518 would be required to do the job, of which $20,778 was needed for the Forest Service's share and $18,740 for private and State participation.

Through the interest of the local people and their State representatives, quick action on the part of the State Legislature was obtained in amending the pine beetle control law so as to permit State aid in beetle control on private lands and in obtaining an emergency appropriation of $10,000 to finance the State's share of this work. Upon the approval of this fund, the State Forester set up a "zone of infestation," which included all the areas shown on the attached map. The State Board of Forestry approved the expenditure of this fund on a cooperative basis with the provision that the State's share in the work on private land would not exceed 50 percent of the total cost on such lands over the area as a whole. The State Forester then contacted all the private owners and agencies in the

area where control seemed to be justified and obtained from them a promise of private contributions totaling about $12,500, which included allowances for contributed labor, transportation and equipment furnished.

The Forest Service allotted $13,500 for labor and expenses of work on National Forest lands as well as the approval of a 14-man C.P.S. camp to aid on the project. In addition, they were prepared to put in a considerable amount of contributed time of their regular personnel.

Both the Forest Service and the State established control camps in the area and by February 19, 1945, actual control operations were underway.

The present report gives the details of the control work accomplished during the period February 19 to April 30, 1945, and the results obtained in controlling this bark beetle outbreak.

I. DESCRIPTION OF THE AREA

Under the new State pine beetle control law, the Burney-McCloud Insect Control Project was set up by the State Forester as a "zone of infestation," covering 383,000 acres in eastern Shasta and southeastern Siskiyou Counties (see map A). Of this total acreage, about 132,000 acres had been cutover, much of it many years ago. On most of the older cutting areas which were located in the McCloud Flats and Bear Creek units, the insect problem was not acute and no control was proposed for such units. The total zone of infestation has a pine timber resource of about 3½ billion board feet on the virgin areas and about one-quarter billion board feet on the cutover lands. Of the total acreage, about 68 percent is privately owned with 32 percent in government ownership. In the virgin areas the timber type is about 46 percent mixed ponderosa and sugar pine, 20 percent mixed ponderosa and Jeffrey pine, 29 percent pure ponderosa pine, and 5 percent mixed oak and light ponderosa pine. (For a more detailed discussion of the forest resources and types see P. C. Johnson's Memorandum for the files on Forest Resource Statistics for the units of the Burney-McCloud Insect Contfol Project. March 23, 1945 (5)

II. HISTORY OF THE INFESTATION PRIOR TO CONTROL

Much of the area within the treated zone in the Burney-McCloud Insect Control Project zone of infestation includes over-mature, slow-growing high-hazard stands where average losses for the past 15 years have considerably exceeded increment. The loss pattern in this area has been quite similar to that for the other eastside ponderosa pine areas in California having similar stand characteristics.

1942. Timber losses in ponderosa and sugar pine in this general area reached a very low point in the infestation cycle in 1942. Losses for the Burney area were estimated at less than 50 board feet per acre for that year.

1943. Following this low point, a definite increase in losses was apparent in 1943, particularly on and adjacent to scattered "shot-gun" cuttings made in 1942 and 1943. This increase was most marked in the Hat Creek, Burney Flat and Goose Valley units where cuttings had been made and in a part of the McCloud Flat unit where heavy snowbreak had occurred during the winter of 1942-43. The infestation in 1943 was predominantly caused by Ips confusus which late in the winter caused the killing of moderate sized groups of poles and merchantable trees on or close to these recent cutting areas.

A control job was carried on jointly by the U. S. Forest Service and the McCloud River Lumber Company in the McCloud Flat unit early in the spring of 1944; 191 trees and 250 poles, containing a volume of 166,000 board feet, were treated at a cost of $1,500. This control job, even though minor in scope, appeared to have furnished very effective control in this local area.

1944. The 1943 overwintering generation of bark beetles was followed by a moderate increase in the first and second summer generation with a tremendous build-up in population in the third and overwintering generation for 1944. This infestation was one characteristically dominated by Ips confusus with Dendroctonus brevicomis playing a secondary role of filling in the green bases of topkilled trees and occasionally killing individual trees in advanced stages of decadence.

Infestations of serious proportions showed up in local areas in the Clark Creek, Burney Flat, Goose Valley, Dry Lake, Doyle Butte, Hat Creek and Soldier Mountain units. Heavy losses in 1944 were not entirely confined to cutting areas, but with practically no exception they were in the near vicinity of cutting areas and rarely did the large grouping tendency ever extend more than a mile from an area recently logged.

Groupings of several hundred poles and a few trees were commonly found on the 1943 and 1944 cutting areas, while groups up to 30 merchantable trees were occasionally found on virgin areas around these cuttings, and in one case 85 merchantable trees and 15 poles were found.

Although these losses were of a spotty nature, in the aggregate they usually made for a heavy loss in the units affected. Most of the large groups were located in conspicuous places where they could be seen from roads and this fact had a considerable influence on some of the first estimates of losses that were made for the area. Practically all of the first estimates were considerably higher than that which was actually found in spotting. The following loss estimates for units are from a series of permanent sample plots and road strips located in this area.

(a) Burney Flat unit

Losses in the Burney Flat unit were heavier on the average than for any of the other units. Much of this is presumed to have been directly traceable to cuttings totaling 3,600 acres in the unit in 1943 and 1944. Losses in 1944 for the unit as a whole, including both virgin and cutover, were estimated at 163 board feet per acre on 24,090 acres (Table 1). Losses on the virgin areas were estimated at 177 board feet per acre on 19,010 acres. Losses in the north end of the unit (where control was later carried on) were estimated at 234 board feet per acre on 11,720 acres and at 83 board feet per acre on 7,290 acres of virgin area in the south end of the unit. Losses in 1944 on cutover areas were estimated at 110 board feet per acre on 5,080 acres for the unit as a whole, being 135 board feet per acre in the north end of the unit on recent cuttings of 1943 and 1944, and being 50 board feet per acre on 1,480 acres in the south end where the cuttings averaged much older.

(b) Other units

Other serious infestation centers were found in the Goose Valley unit in the vicinity of the Haynes Ranch and south and east of the Goose Valley Ranch where recent cutting had presumably caused a local build-up of Ips populations. Serious group killings were also found in the Doyle Butte, Hat Creek, Clark Creek, Dry Lake and Soldier Mountain units. For detailed unit losses in 1944 and 1945 see Table 1.

III. FACTORS INFLUENCING CONTROL RECOMMENDATIONS

There were five main factors that influenced control recommendations being made in the Burney-McCloud area.

1. The serious Ips outbreak that started in 1943 had showed a material acceleration in 1944. The areas infested in 1943 had greatly expanded and new groups were forming in 1944 on areas where none had occurred in 1943. These latter groups were scattered over a considerable area of virgin timber and it was felt that these groups were forming a focal point for further serious losses in surrounding virgin timber.

2. Many of the trees partly killed by Ips had become heavily infested with D. brevicomis and were considered as a potential source of serious trouble if no control work was undertaken.

3. A great bulk of the infested material was in the near vicinity of the Burney Mills and it was expected that a very high percentage of this material could be salvaged at the time of the control operation.

4. A control operation against an infestation dominated by Ips confusus had been undertaken in the spring of 1944 jointly by the Forest Service and the McCloud River Lumber Company in the McCloud Flats unit and had apparently produced very encouraging results. It was felt that this

evidence, though meager, justified the recommendation of control under infestation conditions that were essentially similar.

5. There was a unified local demand for some sort of action on this problem that was constantly becoming more serious.

IV. ORGANIZATION OF THE CONTROL WORK

A. Cooperators

This job was set up on a closely knit cooperative basis with all agencies doing thir utmost to assure the success of the project. Cooperating agencies included the Bureau of Entomology and Plant Quarantine, U. S. Forest Service, California State Division of Forestry, California State Division of Parks, California State Division of Highways, McCloud River Lumber Company, Fruit Growers Supply Company, Scott Lumber Company, Burney Lumber Company, Burney Boy Scouts, Alvin Haynes and other small ranch owners.

1. Bureau of Entomology and Plant Quarantine.

The Forest Insect Laboratory of the U. S. Bureau of Entomology and Plant Quarantine was called upon to act as entomological consultant for the project and to have overall advisory supervision and coordination of the whole project. It was its job to outline the necessary entomological requirements for each unit, to suggest the priority of areas to be treated, to train and supervise spotting and treating crews, and to see to it that the job of all agencies was carried on in such a way as to obtain maximum effectiveness of the work done.

An Entomological Work Plan for this project was prepared by F. P. Keen on February 17, 1945, (4) in which he set up a series of entomological units for the project and outlined the priority of areas to be treated, the type of trees to be spotted and the general method of treatment. The writer was designated as the Bureau's representative in charge of the entomological phases of the problem, assisted by C. E. Startt of the Hat Creek field laboratory and W. J. Buckhorn, on temporary detail from the Portland forest insect laboratory.

2. California State Division of Forestry.

The State Division of Forestry was designated as the agency responsible for conducting control on private land within the project area in close cooperation with all private agencies. In most cases, the State carried on the spotting and treating work on private lands and was reimbursed in money or labor by the private agencies. In the case of the McCloud River Lumber Company, the McCloud people did practically all of their own treating with assistance from the State on spotting.

Melvin Pomponio was designated as field representative by the State Division of Forestry and was assisted by Jesse Graves.

3. U. S. Forest Service

The U. S. Forest Service was responsible for control work on national forest land within the project area. Oscar Barnum was designated as the field representative for the Forest Service under the direction of Vance Brown.

4. California State Division of Parks.

The California State Division of Parks was responsible for control on the McArthur-Burney Falls State Park. This work was carried on under the leadership of E. J. Pool.

5. California State Division of Highways.

The California State Division of Highways cooperated on the project in conducting control on the highway rights-of-way within the project area.

6. Private Cooperators.

The McCloud River Lumber Company expended approximately $8,000 in control on land in the Clark unit where it has pine timber cutting rights.

The Fruit Growers Supply Company contributed $2,000 in cash plus the time of its forester Charles Backman for control work on its land.

The Scott and Burney Lumber Companies contributed in a major degree to the success of the project through the joint salvage of over 2,500,000 board feet of infested timber where no treatment was necessary in the merchantable material taken to the mill. Other private contributors included Alvin Haynes, Edna Black, Ella P. Braden, Barbara Startt and David Doyle.

7. Others.

The Burney Boy Scouts made a real contribution to the project by taking over the responsibility for control within the confines of the town of Burney.

B. Plans and Objectives

1. Salvage Objectives.

This job was set up primarily with the idea that as much of the infested material as possible would be salvaged in the control program. All the timber-owning agencies in the area, except the McCloud Company, consented to the contribution of free stumpage of all infested material to any operator willing to salvage it. The McCloud Company did its own salvage work. The Scott and Burney Lumber Companies entered whole-heartedly into the program and agreed to log out as much of the infested material as their facilities would permit and for a number of weeks both companies had their full woods and mill force working on the project.

2. Method of Spotting.

The Entomological Work Plan originally called for the spotting of all D. brevicomis, D. monticolae and flathead infested trees with infestation showing up in the basal portion; Ips-infested trees if in groups of more than three trees, and providing they were below 20 inches d.b.h., even though only a portion of the top was faded; and on areas where salvage was possible, dying trees of doubtful infestation were to be included if the owner of the timber so desired. This method of spotting was adopted by the McCloud Company and initially used on some of the early spotting on Forest Service areas. This system was later changed on the Forest Service areas and the "dying-doubtful" trees were not included in spotting. On Fruit Growers Supply land only those trees showing infestation in the basal portion were spotted.

It was later found that the areas where the "dying-doubtful" trees were removed were those with the lightest infestation in 1945. One-half section sample where an area was remarked and the dying and doubtful trees left, the spotting of this area in late fall of 1945 showed 21 infested trees and of the 21, 15 were trees on which the treating mark had been chopped off.

The conventional three-man spotting crew was used as a spotting unit on the areas of Burney Flat, Clark Creek and Goose Valley where intensive control was carried on. In the balance of the units of Dry Lake, Doyle Butte and Hat Creek, reconnaissance spotting was done to locate large group concentrations.

3. Method of Treating.

The method of treating used on this project was governed by the factor of salvage. Where no salvage was possible it was the regular conventional method of cut-peel-burn on D. brevicomis and flathead infested trees and cut-burn those trees infested with Ips.

Where salvage was possible the treating crews followed up the logging operation and treated any infested portions that might remain after logging. All salvage portions were taken to the mill and dumped into the pond and in most cases this material was sawed into lumber within a week and the infested slabs were burned in the incinerator.

C. Amount of Work Accomplished

Both the State (6) and the Forest Service (7) have prepared reports on the work accomplished by their respective agencies and data from these reports have been combined in a summary in Table 2. There is some difference in volumes as reported by Brown (7) and those used in table 2. This difference is due to the fact that the Forest Service's figures on volume were for net volume and the figures used in table 2 are gross volume.

There follows a summary of the work accomplished on the Burney-McCloud project through cooperative control efforts.

Acreage - Volume and trees treated:	
Timbered acres treated	26,760 acres
Volume treated on a salvage basis	3,621,600 bd. ft.
Volume treated on a direct basis	1,025,710 bd. ft.
Total volume treated	4,647,310 bd. ft.
Total number trees treated	4,959 trees
Total number poles treated	9,417 poles
Values realized:	
Volume of timber salvaged	3,512,600 bd. ft.
Stumpage value of timber salvaged at $5.50 per M	$19,320
*Estimated reduction in loss or timber saved by control (Table 10)	4,500,000 bd. ft.
Stumpage value of timber saved at $5.50 per M	$24,750
Total volume of timber salvaged or saved	8,012,600 bd. ft.
Total stumpage value saved or salvaged	$44,070
Total cost of control project	$37,800
Balance net gain	$6,270

*Based on the assumption that the 1945 losses would have been the same as 1944 if no control work had been done.

Unfortunately no segregation was made whereby the "dying-doubtful" trees can be separated from those actually infested in the basal portions. For the Clark Creek unit it is estimated that about 40 percent of the total volume spotted would fall in the "dying-doubtful" class. In the Burney Flat unit it is estimated that the overall volume of "dying-doubtful" trees would not exceed 15 percent. In all other units no dying-doubtful trees were spotted so the treated volume in these units represents the gross volume of infested material spotted.

For the project area as a whole there was a total of 24,540 acres treated by formal spotting and an additional 2,220 acres spotted by reconnaissance.

The average performance of the spotting crews on formal spotting was 81 acres per man-day. Records are not available on the performance on areas spotted by reconnaissance.

For the project area as a whole, there was a total of 9,417 poles, 4,959 trees and 4,647,310 board feet of volume treated on 26,760 acres. Of the volume treated, 1,025,710 was by direct control and 3,621,600 board feet was by salvage control (Table 2).

Unfortunately, time records were not kept on a uniform basis for all agencies and it is impossible to furnish accurate figures on board feet treated per man-day by the different methods except for the State job where its records show that it was possible to treat 834 board feet per man-day by direct methods and 1,858 board feet per man-day where the merchantable portion was salvaged.

The average number of trees treated per section was 119, the average number of poles treated per section was 225 and the average volume treated per acre was 174 board feet. The size of the average tree was 28 inches d.b.h. and contained 940 board feet and the size of the average pole treated was about 8 inches d.b.h.

In addition to the data presented in Table 2, the Burney Falls State Park treated by direct methods a total of 77 infested trees and 39 poles containing a volume of 53,999 board feet on 340 acres. In addition, a number of "dying-doubtful" trees were cut and utilized for wood.

D. Amount of Timber Salvaged

Table 3 and 4 present data on the amount of timber spotted for salvage control together with the volume actually removed in the salvage operation. Note that the McCloud Company spotted 1,546,000 board feet gross scale but were able to utilize only 925,000 board feet. The McCloud Company did not include any snags in its salvage. For the balance of the salvage operation no record was kept of the amount of snags removed with the infested material and the data on salvage include these. In all of the units there was a total of 1,784,270 board feet salvaged from Forest Service land; 925,000 board feet from McCloud lands and 795,230 board feet from Fruit Growers land, making a total of 3,512,600 board feet of total salvage from all ownerships.

Table 4 shows the breakdown by amounts salvaged by the different operating companies. This shows that the McCloud Company salvaged 925,000 board feet; the Scott Lumber Company salvaged 1,226,000 board feet; the Burney Lumber Company salvaged 1,338,500 board feet; and miscellaneous small operators salvaged 23,100 board feet. The actual cost of salvaging the material by the Burney Mills, including falling, limbing, bucking, skidding, loading and hauling was about $14 per thousand.

E. Cost of the Project

Table 5 shows a breakdown in the expenditures of the State Division of Forestry and Forest Service funds insofar as is possible for direct control work. Table 6 shows the actual and estimated expenditure by the various cooperating agencies. The total expenditure of State, federal and private funds on this project is estimated at $37,800 to treat 14,376 trees and poles containing a volume of 4,647,310 board feet on 26,760 acres which afforded protection to an estimated 125,000 acres of timber.

V. APPRAISAL OF THE PROJECT AND RESULTS

A. For the Project as a whole

1. Special conditions affecting the results

No control job, no matter how efficiently done in the late winter and early spring, can be expected to produce results that are 100 percent effective. Some trees are bound to be missed in spotting and treating, because they fail to show fade at the time the area is covered. Some trees are missed in faulty spotting; however, on the whole the spotting work on the Burney-McCloud project was very effectively done. Then, too, some bugs are bound to escape in treatment through loss of bark in falling, skidding and loading and through incomplete burning. Others emerge before the treatment is completed. The Burney-McCloud job was definitely of an emergency nature. There was considerable delay in the allotment of funds, in the crystallizing of plans and in getting the project started and as it turned out there was not sufficient money allotted to the project to complete the whole job.

2. Method of Collecting the Appraisal Data and Cruise Results.

The appraisal of control effects on the project area was carried on on a cooperative basis by the Bureau, the U. S. Forest Service, the State Division of Forestry and representatives of the Fruit Growers Supply and McCloud River Lumber Companies. The Forest Service contributed about a month's time of a three-man C.P.S. crew, the State Division of Forestry cooperated with a four-man spotting crew for about three weeks, and Fruit Growers and McCloud River Lumber Companies assisted in spotting on their respective areas.

Particular emphasis was placed on a re-spotting of the treated areas in the Burney Flat, Clark Creek and Goose Valley units. As a result of this cruise, a total of 5,384 acres was spotted on the treated area of 26,670 acres, making a sample coverage of 20 percent. An additional 5,680 acres were spotted in the balance of the units where no control had been carried on. This represented a sample of about 5 percent of the untreated area.

Table 7 presents data on the samples cruised in the Burney Flat treated area in 1944 and again in 1945 and shows that the average loss per acre in 1944 was 211 board feet contrasted to 48 board feet per acre loss in 1945; or a reduction in loss in 1945 of about 77 percent. Table 8 presents data on the samples cruised in the Clark Creek unit and shows that losses on these samples for 1944 were 360 board feet per acre and were reduced to about 12 board feet per acre in 1945; or a reduction of about 97 percent brought about presumably by control. From these sample data, an attempt has been made to appraise control results.

3. Reduction in 1945 Loss

On the whole, the control work done last spring appears to have had a beneficial effect in eliminating Ips concentrations and reducing the threat of serious build-up of western pine beetle populations on the areas treated. In fact, Ips populations were so greatly reduced that four "shot-gun" cuttings made within the treated zone in the spring of 1945 showed practically no loss from Ips. Western pine beetle infestation was also reduced to less than 50 board feet per acre.

On areas outside of the control zone, Ips infestations are still conspicuous in a few localities with few large group concentrations comparable to those of last year showing up this year in any portion of the area. Two "shot-gun" cuttings made in the spring of 1945 have shown losses characteristically similar to those of last year, but in general Ips infestation has been greatly reduced throughout the controlled and contiguous areas. Western pine beetle, D. brevicomis, infestation on the other hand increased in 1945 on areas not covered with control work and now dominates the infestation complex.

Table 9 presents a summary of a comparison of the change in losses for 1944 to 1945 by treated and untreated areas. This shows the reduction in losses on the treated versus untreated areas in each unit. Taking the area as a whole, the change in losses on the treated and untreated areas is as follows:

	Treated Area 25,440 acres		Untreated Area 196,770 acres	
	Volume Board Feet		Volume Board Feet	
	Total	Per Acre	Total	Per Acre
Estimated 1944 loss	4,972,280	196	14,357,330	73
Estimated 1945 loss	889,920	35	20,440,610	104
Change in loss volume	4,082,360	161 reduction	6,083,280	31 increase
Percent	82 reduction		42 increase	

B. Control Results by Units

Comparison of losses in the Burney Flat, Clark Creek and Goose Valley units on both treated and untreated areas is shown in Table 10. The individual unit situations are discussed as follows:

1. Burney Flat Unit.

On 11,720 acres of virgin timber treated, it appears that the loss has been reduced from 234 board feet per acre in 1944 to 59 board feet per acre in 1945 or a reduction of about 75 percent. This represents a reduction in loss, primarily from Ips attacks of slightly in excess of 2 million board feet. In contrast to this, portions of the unit where no control was undertaken on virgin stands showed losses, primarily from western pine beetle, increasing from 83 board feet per acre in 1944 to 120 board feet in 1945 or an increase of about 45 percent.

The reduction in loss was particularly striking in cutover areas. For example, two areas cut on a "shot-gun" basis in April and May 1945 within the treated zone, at a time and under circumstances which in 1944 would have been followed by heavy Ips attacks and injury, had practically no loss this season. One half-section sample plot cruised in this 1945 cutting area showed only one small infested tree and no poles killed. On the 3,600 acres of cutover area in the treated portion of this unit, losses were reduced from 135 board feet in 1944 to 12 board feet in 1945, or a reduction in loss of about 91 percent and a saving of 442,800 board feet of timber. Contrasted to this, small areas of older cutover land in the south part of the unit where no control was undertaken showed a slight reduction of only 8 percent in 1945 over 1944 losses.

2. Clark Creek unit.

On the 5,900 acres of virgin timber controlled by the McCloud River Lumber Company and the Forest Service, it appears that the per acre loss has been reduced from about 197 board feet in 1944 to only 12 board feet in 1945, representing a reduction of 94 percent and a saving of about a million board feet of timber. In contrast to this, losses from western pine beetle in the balance of the unit where no control was conducted continued to increase.

Because of lack of manpower at the end of the treating period, there was about a section of heavy infestation spotted but not treated on the McCloud operation at the head of Cayton Valley. This area was subsequently cutover with the operation starting in late spring and continuing until late fall. Losses on this area were greatly reduced in 1945 without control but it is difficult to appraise this because of the presence of fresh logging slash on the area throughout the seasonal activity of Ips.

A "shot-gun" cutting made in May in the southern part of the Clark Creek unit in the portion of the unit where no control was carried on showed heavy residual loss for 1945.

3. Goose Valley unit.

On the 2,320 acres covered with control, losses were estimated to have been reduced from 170 board feet per acre in 1944 to about 22 board feet per acre in 1945, representing a decrease in loss of about 87 percent and a saving of timber of about 350,250 board feet. One small 1945 spring "shot-gun" cutting made within the treated zone showed practically no residual loss for 1945. On the virgin timber stands of this unit where no control was done, losses, primarily from the western pine beetle, were estimated to have increased from 76 board feet per acre in 1944 to 125 board feet per acre in 1945.

4. Dry Lake unit.

Because of limited manpower and money, it was not possible to complete the work in the Dry Lake unit. The only work done here was along the northern

boundary of the unit near the town of Burney where heavy concentrations of Ips-killed poles occurred. Where this work was done it produced very effective results. There was some concentration of losses around Dry Lake and 15 trees containing about 45,000 board feet were spotted but not treated. Many of these trees were only partly topkilled and it was felt that it was worth a gamble to leave them to see if they would recover.

However, losses continued in the area around the Lake until by fall there were 44 completely infested trees where there had been only 15 partly infested trees in the spring. These trees were all large trees and as the loss was well concentrated the Fruit Growers Supply Company made a bug sale of the 44 infested trees to the Burney Lumber Company for $5 per thousand. These trees contained approximately 134,000 board feet of lumber. This is one example of an area where no control was done and where the 1945 losses in a local area increased about 200 percent. Losses, mainly from western pine beetle, in this unit as a whole are estimated to have increased about 78 percent.

5. Doyle Butte unit.

Control in this unit was carried on by treating just the large concentrated groups of Ips-killed trees scattered over the unit and only an aggregate of about 820 acres were actually treated. Losses were greatly reduced in the immediate vicinity of the groups and as all large groups were removed from the unit this appeared to have had a considerable effect on unit losses for 1945. One small "shot-gun" cutting made in this unit showed very light residual losses from Ips. Reduction in the immediate vicinity of the groups was approximately 80 percent with losses for the unit as a whole remaining about the same as in 1944.

6. Hat Creek unit.

Control in this unit was on the same basis as that in the Doyle Butte unit and reduction in losses in the immediate vicinity of the controlled groups where Ips was the dominant species was about 75 percent, while losses in the unit as a whole were estimated as having been reduced by about 40 percent. It is presumed that the control of large scattered groups had a beneficial effect over the whole unit. A spring and summer cutting made in part of the area not treated suffered moderate losses from Ips.

7. Big Springs unit.

No control was carried on in this unit of 40,270 acres and losses showed a marked increase over the unit as a whole. These losses, principally from western pine beetle attack, are estimated to have increased from 63 board feet per acre with a total of 2,537,000 board feet in 1944 to 127 board feet per acre with a total of 5,114,300 board feet in 1945. This represents an increase of slightly more than 100 percent. It is expected that some of this increase in loss can be traced to recent "shot-gun" cuttings throughout this unit.

8. Thousand Lakes unit.

No control was carried on in this unit of 35,690 acres and losses showed a moderate increase in 1945. Estimated losses averaged 60 board feet per acre with a total loss of 2,141,400 board feet in 1944. These had increased to 90 board feet per acre with a total of 3,212,100 board feet in 1945, representing an increase of 50 percent. This increase was mostly attributable to increased western pine beetle activity.

9. Soldier Mountain unit.

Because of lack of funds, no control was carried on in this unit. This unit was largely cutover and heavy concentrations of Ips-killed poles were observed in the reserve areas on the east side of Soldier Mountain near the town of Dana. No formal spotting was done in this unit, but a reconnaissance of the area in 1945 indicated that this Ips infestation had partly subsided but that some infestation was still continuing in this unit with a moderate reduction in total loss for the unit as a whole.

VI. CONTROL RECOMMENDATIONS FOR 1946

While the overall results achieved on the Burney-McCloud Insect Control Project during 1945 have been highly satisfactory in breaking up concentrated Ips infestation and reducing western pine beetle losses on the areas treated, the bark beetle problem in this area is by no means permanently solved. Further follow-up work should be done to maintain present gains while the area is put in the most insect-resistant condition possible.

Much of the area is recognized as of high hazard to western pine beetle attack. Such accessible portions of the area should be covered with a light sanitation-salvage cutting as soon as possible to reduce the chances of loss until the mature timber is finally harvested.

In portions of the area Ips groups still persist in the winter of 1945-46. It would be desirable to eliminate concentrated infestations of this character.

Over the more accessible portions of the Burney Flat unit western pine beetle losses run from 50 to 120 board feet per acre. To the extent that such infestation can be removed through salvage at a low expenditure for direct control, such work should be undertaken. Also it is desirable to maintain control in the Burney Falls State Park and in a zone surrounding it because of the recreational values involved.

If control work along these lines can be carried forward during 1946, it should be possible to give this area adequate protection from further serious bark beetle damage and to maintain and further reduce the present low level of bark beetle infestation in this project area.

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5. Johnson, P. C. — Memorandum for the files re: Forest resource statistics for units of the Burney-McCloud insect control project. 3-23-45. Berkeley, Calif.

6. Pomponio, M. — Report on the emergency Burney-McCloud forest insect control project of 1945. California State Division of Forestry, Sacramento, California. May 1945

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Table 1. Estimated summary of pine losses by units in the Burney-McCloud Insect Control Project Zone for 1944 and 1945

Unit	Status	Timbered acres	1944 No. of trees	1944 No. of poles	1944 Volume board feet Total	1944 Volume board feet Per acre	1945 No. of trees	1945 No. of poles	1945 Volume board feet Total	1945 Volume board feet Per acre
Clark Cr.	Virgin	44,560	6,230	3,322	4,898,500	110	6,000	1,536	4,903,300	110
Burney Flat	Virgin	19,010	3,494	637	3,356,520	177	1,437	361	1,571,320	83
	Cutover	5,080	896	5,700	560,000	110	113	55	111,200	22
	All	24,090	4,390	6,337	3,916,520	163	1,550	416	1,682,520	70
Goose Valley	Virgin	28,190	448	306	2,141,900	76	825	102	3,471,980	125
	Cutover	1,760	477	2,076	351,230	169	60	45	38,720	22
	All	29,950	925	2,382	2,493,130	81	885	147	3,510,600	117
Dry Lk.	Virgin	20,790	374	200	1,247,400	60	436	100	2,224,530	107
Doyle Butte	Virgin	13,570	1,280	500	1,085,600	80	1,200	50	1,017,750	75
Hat Cr.	Virgin	13,290	2,790	560	1,063,200	80	736	50	637,920	48
Big Spgs.	Virgin	40,270	974	100	2,537,010	63	1,888	50	5,114,290	127
Thousand Lakes	Virgin	35,690	1,263	125	2,141,400	60	1,610	25	3,212,100	90
All units	Mixed	222,210	18,225	13,526	19,382,760	87	14,305	2,374	22,303,010	100

Table 2. A summary of the number of trees and poles and gross volume of material spotted and treated on the Burney-McCloud Control Project Area

Unit	Timbered acres in unit	Total timbered acres treated	Ownership	Status	Timbered acres treated	No. of poles	No. of trees	Total	Volume treated - Board Feet* direct	salvage	total
Clark Cr.	44,560	5,900	Forest Service	Virgin	2,420	488	426	914	15,000	395,500	410,500
			McCloud	Virgin	3,480	334	1,076	1,410		1,546,000	1,546,000
			All		5,900	822	1,502	2,324	15,000	1,941,500	1,956,500
Burney Flat	24,090	15,320	Forest Service	Cutover	3,000	4,355	647	5,002	315,000		315,000
			Forest Service	Virgin	5,360	581	884	1,465		1,118,600	1,118,600
			Fruit Growers	Virgin	6,080	205	540	745		538,400	538,400
			Other Private	Cutover	600	569	107	676	54,600		54,600
			Other Private	Virgin	280	32	17	49		8,100	8,100
			All		15,320	5,742	2,195	7,937	369,600	1,665,100	2,034,700
Goose Valley	29,950	2,320	Forest Service	Cutover	1,120	1,312	82	1,394	146,000		146,000
			Haynes	Mostly cut.	400	942	305	1,247	111,200		111,200
			Fruit Growers	Virgin	480	145	115	260	69,300		69,300
			Other Private	Cutover	240	66	34	100	6,600		6,600
			Other Private	Virgin	80	26	40	66	24,400		24,400
			All		2,320	2,491	576	3,067	357,500		357,500
Dry Lake	20,790	80	Fruit Growers	Virgin	80	11	44	55	7,000	15,000	22,000
Doyle Butte	13,570	820	Forest Service	Virgin	400	106	96	202	23,000		23,000
			Fruit Growers	Virgin	400	14	90	104	40,250		40,250
			Other Private	Virgin	20	65	15	80	5,300		5,300
			All		820	185	201	386	68,550		68,550
Hat Creek	13,290	1,000	Fruit Growers	Virgin	1,000	41	218	259	88,060		88,060
Town of Burney			Private	Virgin	320	125	25	150	5,000		5,000
State Div. of Highways			Mixed	Mixed	1,000		198	198	115,000		115,000
All	146,250	26,760	Forest Service	Cutover	4,120	5,667	729	6,396	461,000		461,000
			Forest Service	Virgin	8,180	1,175	1,406	2,581	38,000	1,514,100	1,552,100
Units			Private	Cutover	1,240	1,577	446	2,023	172,400		172,400
			Private	Virgin	13,220	998	2,378	3,376	354,310	2,107,500	2,461,810
*Gross volume			ALL		26,760	9,417	4,959	14,376	1,025,710	3,621,600	4,647,310

Table 3. Summary of material salvaged.

Unit	Ownership	Board feet* volume spotted	Board feet** volume salvaged
Clark Creek	Forest Service	395,500	326,000
	McCloud	1,546,000	925,000
Burney Flat	Forest Service	1,118,600	1,458,270
	Fruit Growers	538,400	789,230
	Others	8,100	8,100
Dry Lake	Fruit Growers	15,000	15,000
ALL UNITS	Forest Service	1,514,100	1,784,270
	McCloud	1,546,000	925,000
	Fruit Growers	553,400	795,230
	Others	8,100	8,100
	All owners	3,621,600	3,512,600

*Gross volume of timber spotted.
**Net volume of timber logged to mill, includes some snags.

Table 4. Summary of salvage on the Burney-McCloud Control Project

Scott Lumber Company

F.S. Clark Creek	326,000 board feet
F.S. Burney Flat	581,000 board feet
F.G.S. Burney Flat	319,000 board feet
	1,226,000 board feet

Burney Lumber Company

F.S. Burney Flat free	661,270 board feet
F.S. Burney Flat regular stumpage	216,000 board feet
F.G.S. Burney Flat free	461,230 board feet
	1,338,500 board feet

TOTAL ALL COMPANIES

McCloud River Lumber Company	925,000 board feet
Scott Lumber Company	1,226,000 board feet
Burney Lumber Company	1,338,500 board feet
Misc. small operators	23,100 board feet
Total	3,512,600 board feet

Table 5. Expenditure break-down by items

	State		Forest Service	
	Amount	Mandays	Amount	Mandays
Labor (paid)	$4,802.23	563	$9,758.05	1,394 (est.)
Labor (contributed-regular)	4,501.50	677	1,647.00	217
Labor (contributed C.P.S.)			1,107.00	443
Total Labor	$9,303.73	1,240	$12,512.05	2,054
Transportation	308.37		1,431.86	
Supplies	1,509.05		2,114.46	
Misc.	381.35		237.63	
Total Expenditure	$11,502.50		$16,296.00	
Total Mandays		1,240		2,054

Estimated mandays, Private 880
Total mandays, Forest Service, State and private 4,174

Table 6. Cost of the Project

EXPENDITURE BY AGENCIES

State Division of Forestry	$9,500.00*
State Division of Highways	1,500.00 (est.)
Fruit Growers Supply Company	2,000.00*
McCloud River Lumber Company	8,000.00 (est.)
Small private owners	500.00 (est.)
U. S. Forest Service	16,300.00
Total	$37,800.00

*Expended by State Division of Forestry

AVERAGE COST

Average cost per acre treated	$1.41
Average cost per acre protected (125,000)	.30
Average cost per thousand board feet	8.13
Average cost per pole and tree	2.62

AVERAGE PERFORMANCE PER MANDAY (Total 4,174)

Average number acres per manday	6.4 acres
Average number thousand board feet per manday	1113 board feet
Average number poles and trees per manday	3.4

Table 7. Cruised sample, pine losses, Burney Flat treated area, 28.3% sample.

Plot or Strip	Acres	1944 loss before control: Number trees per section	1944 loss before control: Volume per acre board feet	1945 loss after control: Number trees per section	1945 loss after control: Volume per acre board feet
Plot #1	20	608	798	0	0
2	20	1,728	438	0	0
4	20	256	501	0	0
6	20	256	540	64	257
7	20	96	167	32	1
Road- 1	320	170	286	38	56
strip 2	336	101	154	36	52
3	200	131	241	32	14
4	192	140	206	20	27
5	240	104	67	21	19
6	176	131	194	4	1
T.36N., R.3E.					
E/2 Sec. 28	320	234	315*	52	44
E/2 Sec. 33	320	120	160*	44	52
S/2 Sec. 32	320	164	220*	46	63
3/40s Sec. 4	120	133	180*	48	39
W/2 Sec. 11	320	210	280*	22	31
E/2 Sec. 16	320	150	200*	20	26
E/2 Sec. 21	320	130	175*	50	81
E/2 Sec. 22	320	134	180*	30	53
E/2 Sec. 27	320	172	230*	2	1
Total	4,344				
Average		157	211	30	40
Estimated 1945 loss per acre					48

Cruised sample, pine losses, Burney Flat untreated area, 11.3% sample

Road- 7	344	45	55	41	71
strip 8	192	66	107	70	101
9	376	58	66	83	110
Plot #9	20	64	136	32	113
11	20	160	184	192	172
12	20	96	77	64	24
13	20	192	263	64	101
Total	992				
Average		54	78	66	94
Estimated 1945 loss per acre					108

*1944 loss estimated from permanent sample plots and roadstrips in each section. 1945 lose for these plots are actual cruised losses.

Table 8. Loss data from cruised samples, 1.8% sample, in the Clark Creek unit.

Area	No. acres	1944 Volume Loss Bd.ft./ac.	1945 Volume Loss Bd.ft./ac.
T.37N., R.3E Sec. 32 S/a	320	312*	16
T.37N., R.2E Sec. 6 E/2	320	510*	5
Secs. 17-18, 37N., 3E Roadstrip	160	160*	6
Average	800	360	10
Estimated 1945 loss			12 bd.ft./acre

*Estimated from 1944 spotting records.

Table 9. A summary of comparison in change in estimated losses from 1944 to 1945 on treated and untreated units in the Burney-McCloud Control area

Unit	Treated Area			Untreated Area	
	Type of Control	Acres	Reduction in loss volume-board feet	Acres	Increase in loss volume-board feet
Clark Creek	Complete coverage of all infested trees 100% spotting	5,900	1,094,110	38,660	1,098,910
Burney Flat	do	15,320	2,497,160	8,770	263,160
Goose Valley	Complete coverage of concentrated group areas 100% spotting	2,320	350,250	27,630	1,367,720
Dry Lake	Control of scattered groups along north boundary of unit, only group spotting	80	20,000	20,710	997,130
Doyle Butte	Control of scattered groups in entire unit, group spotting	820	54,840	12,750	13,010 (decrease)
Hat Creek	do	1,000	66,000	12,290	359,280 (decrease)
Big Springs	No control			40,270	2,577,280
Thousand Lks.	No control			35,690	1,070,700
ALL UNITS		25,440	4,082,360	196,770	7,002,610

Table 10. Comparison of estimated losses on treated and untreated units in 1944 and 1945 on areas intensively treated.

Unit	Status	Acres	1944 Loss				1945 Loss				Change in loss volume bd. ft.
			No. of trees	No. of poles	Volume board feet Total	Per Acre	No. of trees	No. of poles	Volume board feet Total	Per Acre	
Burney Flat (treated)	Virgin	11,720	2,830	517	2,746,520	234	595	250	692,160	59	2,054,360 reduction
	Cutover	3,600	820	5,660	486,000	135	44	11	43,200	12	442,800 reduction
	Total	15,320	3,650	6.77	3,232,520	211	639	261	735,360	48	2,497,160 reduction
Burney Flat (untreated)	Virgin	7,290	664	120	610,000	83	842	111	879,160	120	269,160 increase
	Cutover	1,480	76	40	74,000	50	69	44	68,000	46	6,000 reduction
	Total	8,770	740	160	684,000	78	911	155	947,160	108	263,160 increase
Clark Creek (treated)	Virgin	5,900	1,330	822	1,164,900	197	125	36	70,800	12	1,094,110 reduction
Clark Creek (untreated)	Virgin	38,660	3,900	2,500	3,733,600	96	4,500	3,000	4,832,500	125	1,098,910 increase
Goose Valley (treated)	Cutover	2,320	633	2,740	393,250	170	30	60	43,000	22	350,250 reduction
Goose Valley (untreated)	Virgin	27,630	440	-	2,099,880	76	803	-	3,467,600	125	1,367,720 increase

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE
DIVISION OF FOREST INSECT INVESTIGATIONS

INSECT CONTROL UNITS

BURNEY-Mc CLOUD INSECT CONTROL PROJECT

SHASTA AND SISKIYOU COUNTIES, CALIFORNIA

SCALE
0 1 2 3 4 5 6
MILES

R.3W. R.2W. R.1W. R.1E. R.2E. R.3E. R.4E. R.5E.

T.41 N. T.40 N. T.39 N. T.38 N. T.37 N. T.36 N. T.35 N. T.34 N. T.33 N. T.32 N. T.31 N.

McCLOUD FLATS
BEAR CREEK
CLARK CREEK
GOOSE VALLEY
BURNEY FLAT
DRY LAKE
DOYLE BUTTE
HAT CREEK
THOUSAND LAKES
BIG SPRINGS
LASSEN VOLCANIC
F O R.
CALIFORNIA
OREGON
MT. SHASTA
TO REDDING

AREAS TREATED IN THE BURNEY-MCCLOUD CONTROL PROJECT

Agency Conducting Control

U. S. Forest Service

Cal. State Division of Forestry

McCloud River Lumber Company

Burney Falls State Park

Burney Boy Scouts